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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : F16L 1/16 — A1

(11) International Publication Number: WO 92/20947

(43) International Publication Date: 26 November 1992 (26.11.92)

(21) International Application Number: PCT/NO92/00094

(22) International Filing Date: 19 May 1992 (19.05.92)

(30) Priority data:
912018 24 May 1991 (24.05.91) NO

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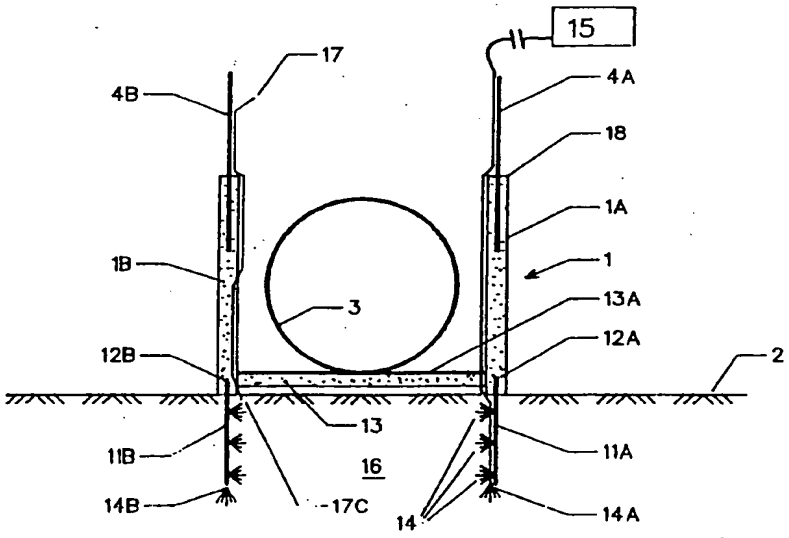
(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), MC (European patent), NL (European patent), SE (European patent), US.

Published
With international search report.
In English translation (filed in Norwegian).

(54) Title: CHANNEL ELEMENT AND METHOD FOR LAYING PIPELINES UNDERGROUND



(57) Abstract

Channel element and method for laying pipelines underground for bringing ashore, for example, gas and/or oil in regions where the seabed (2) consists of loose masses such as sand, in particular in beaches and marshlands. This channel element (1) comprises an upwardly open cross section with sidewalls (1A, B) and a bottom (13) which internally is adapted to support one or more pipelines (3). There is provided a plate-shaped skirt (11A, B) along each side of the channel element (1) and projecting below the bottom (13) thereof, substantially aligned with each respective sidewall (1A, B). In the space (16) between the skirts (11A, B) underneath the bottom (13) there are provided nozzle devices (14, 14A, B) for supplying water and fluidizing loose masses in the space (16). Moreover there is provided at least one suction tube (17) for connection to an external pump and having its mouth (17C) open into the space (16) for removing fluidized loose masses therein.

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CHANNEL ELEMENT AND METHOD FOR LAYING PIPELINES UNDERGROUND.

This invention relates to a channel element for burying pipelines for bringing ashore, for example, gas and/or oil in regions where the seabed consists of loose masses such as sand. The invention also comprises a method for such burying of pipelines. Beaches and marshlands in particular are of interest in this connection, since nature conservation considerations, inter alia, can make it difficult to use conventional and known methods for bringing ashore pipelines of the kind contemplated here. These pipelines can have large dimensions and this accentuates the problems of gentle and safe conveyance to dry land.

More specifically, under such circumstances it is not possible to employ the usual heavy equipment during the construction work, at the same time as the construction time period in many cases should be as short as possible. Another important consideration is that the pipelines through shore regions should be hidden and have sufficient cover, both for safety reasons and for purely environmental reasons.

Even though the particular conditions in beaches and marshlands constitute the initiating impulse for the development of this invention, the novel method with associated elements to be described here, can also be contemplated for employment along other parts of the pipeline paths, including deeper path portions under water.

Several methods of bringing ashore pipelines through shore zones are previously known. One method consists in the employment of pile planking followed by the digging of a trench for the pipes. This requires the use of hammers for driving down the pile planking elements, which involves noise and, besides, the employment of excavators as well as continuous bracing of the pile planking wall, and finally filling, and the retracting of the pile planking when the pipeline is laid and finished. In addition to the noise nuisance this method requires a long period of construction and there is a

need for comprehensive and heavy equipment for the required operations.

Another method consists in pulling the pipeline from the sea onto the land and subsequently to plough it down after laying in the desired path. This method requires large equipment units for pulling the pipe and a special plough for the burying. Besides the seabed, which often consists of sand, will be able to slide in, so that the necessary trench to be ploughed will be rather wide. After filling, the mass can be carried off by tide water and waves so that the required cover cannot be guaranteed. Thus, wounds in the landscape can be the result.

A further known method is directed to fluidizing the loose masses underneath the pipe sections in order to form a wide trench. A drawback here is that the filling of the trench is difficult.

Finally from Norwegian patent 1.492.289 there is known a more or less bridge-like, elongated channel element for bringing ashore pipelines, whereby, however, the precondition is a highly irregular topography with hills, valleys, depressions, peaks, or the like, in the shore zone. These are quite different conditions from those to which the present invention is directed.

In similarity to what is described in the above Norwegian patent specification, the channel element according to the invention comprises an upwardly open cross-section having side walls, and a bottom which internally is adapted to support one or more pipelines.

What is novel and specific in the channel element according to the invention, in the first place, consists therein that there is provided a plate-shaped skirt along each side of the channel element and projecting below the bottom thereof, preferrably substantially aligned with each side wall respectively, that in the space between the skirts underneath the bottom there are provided nozzle devices for supplying water and fluidizing loose masses in the space, and that there is provided at least one suction tube for connection to an external pump, having its mouth open into the space for removing fluidized loose masses therein.

It is a practical advantage to manufacture the channel elements of reinforced concrete, whereas the plate-shaped skirts can consist of steel plates, but also other material combinations can be contemplated. A point of interest in this connection is that the weight of the elements alone should be sufficient to make the skirts penetrate a distance into the loose masses concerned, by placing the elements on the seabed. The thickness and the configuration of the plate-shaped skirts should be adapted in view of this consideration.

As indicated above the foundation or installation of such channel elements takes place by jet effect with the fluidizing and the removal by suction of underlying loose masses, so that each element of its own accord sinks down to the desired level. The claims contain closer statements of two alternative methods according to the invention.

The invention makes it possible to install pipelines through a shore zone in a environment-friendly manner, so that the problems involved with available, known technology are avoided. Moreover, this new method may lead to savings because it does not require the use of large and heavy machines and equipment for the construction work.

In the following description the invention will be explained more closely with reference to an exemplary embodiment illustrated in the drawings, wherein:

fig. 1 shows a simplified cross-section of a channel element of concrete placed on the seabed and with a pipeline arranged on the bottom of the channel element,

fig. 2 shows a corresponding cross-section as in fig. 1, after lowering the channel element to the desired level and,

fig 3 shows in schematic longitudinal section a series of channel elements in buried position with an associated pipeline extending from the sea through a shore zone.

In the example of a channel-shaped concrete element 1 which is shown in figs. 1 and 2, the element comprises a bottom 13 and side walls 1A and 1B. The internal chamber

thereby formed serves to receive one or more pipelines 3, which usually will be pulled in, in their longitudinal direction from the sea, in order to be extended through a shore zone, e.g. a marshland. In order to facilitate such pulling of the pipeline 3, the bottom 13 can be covered with a friction reducing coating 13A, e.g. of teflon or a similar material.

In fig. 1 the concrete element 1 is placed on a seabed 2, for example by means of a crane which can be moved on the seabed by caterpillar means, or it can be run successively out on rails being provided on the elements as these are laid out with a starting point on more or less dry land. Another alternative could be the employment of a particular crane vessel which can operate in very shallow water.

Approximately aligned with with the side walls 1A and 1B there are provided plate-shaped skirts 11A and 11B respectively, which project downwards to a suitable distance underneath the bottom 13. In the space 16 lying between the skirts 11A, 11B and underneath the bottom 13, there is confined a volume of the loose mass which forms the seabed 2. It is a main idea of the invention that lowering or burying of the concrete element 1 takes place by introducing water into this space 16, for the purpose of fluidizing the loose masses therein so that these loose masses can be removed in a fluidized or water-mixed condition. To this end there are provided nozzle devices in the space 16, for example in the form of jet tubes and nozzles 14 which, through supply tubes, are connected to water pump equipment 15 which can for example be common to a number of concrete elements 1 at a given construction site.

The placement of a concrete element 1 with skirts 11A, 11B projecting more or less into the seabed 2, as in the position shown in fig. 1, in the first place is done without any use of nozzle effect, as the dimensions and the shape of the skirts are so chosen, in relation to the weight of the actual concrete element 1 with side walls 1A, 1B and bottom 13, that the skirts will penetrate to a distance down in the loose mass concerned, under the influence of the weight of the concrete element alone.

As shown at 12A and 12B the skirts 11A, 11B are cast into the concrete element 1 so as to obtain good adherence. Besides, it is obvious that the concrete element 1 is provided with suitable reinforcements in order to obtain the required strength.

At the upper portion in extension of each side wall 1A,B upwards, there are shown supporting plates 4A and 4B which have a specific function in connection with the burying of the element to the desired depth, which is to be explained further below.

For the purpose of removing fluidized loose mass from the space 16 there is, moreover, provided at least one suction tube 17, the mouth 17C of which is open towards the space 16. In the example of fig. 1 the mouth 17C is located at a corner region between the bottom 13 and the skirt 11B. Such a position of the suction mouth 17C can be advantageous in many cases.

The suction tube 17 leads to pump equipment being suited for pumping out the above mentioned mixture of water and loose mass, for example sand, from the space 16. The water tubes and nozzles 14 for fluidizing these loose masses can with advantage be located internally on the two skirts 11A, B, preferrably also with somewhat downwardly directed nozzles 14A and 14B at the lower edges of the skirts.

In the starting position shown in fig. 1 before lowering or burying by means of jet effect, the pipline 3 is placed or pulled into the channel element. According to a preferred embodiment of the method according to the invention however, the pipeline is placed in the channel elements only when a series of these elements of a required number has been lowered to the desired level underneath the seabed, so as together to form a smooth guiding channel for a pipeline.

From the starting position of fig. 1 each channel or concrete element 1 is lowered by injecting water through the nozzles 14 and 14A, B. At the same time suction from the mouth 17C is initiated through suction tube 17. As loose masses are by and by removed from space 16 element 1 will sink down into the seabed 2, and this takes place in a controlled manner depending upon the amount of water supplied and

the pumping out power. This can be adjusted by means of a suitable control unit which as the case may be, can be common to a series of channel elements in a given installation.

When the element 1 has been lowered so much that the top 18 of the side walls approach the seabed 2 the above mentioned supporting plates 4A, B will begin to function. These are provided so as to make possible the burying of each element at a certain depth underneath the seabed. A usual requirement to such burying or cover is a minimum of 1 meter, i.e. no part of the finished construction shall be closer to the sea bottom after finished work, than 1 meter.

For this purpose the supporting plates 4A, B are detachably mounted in slits 19A, B in the respective side walls 1A, B. With the supporting plates 4A, B in position the burying therefore can proceed until a depth, for example as indicated as sea bottom at 2', whereby the height difference between the two seabed levels 2 and 2' in fig.2, will be for example more than 1 meter. The height of the supporting plates 12A, 12B above the upper edge 18 of the side walls, therefore, must be correspondingly dimensioned. Moreover, the supporting plates 12A, B and the attachment 19A, B thereof in side walls 1A, B must be sufficiently strong for the structure to resist the exterior pressure of the loose masses of the seabed when the burying has proceeded to a depth corresponding to the sea bottom level 2' in fig. 2, or in other words to the maximum burying depth.

Then in the preferred embodiment at this stage a pipeline 3 is laid or pulled into the row of elements 1 which have been buried in this way.

When the whole pipeline 3 has arrived at a correct position, loose masses 7 of a suitable character, for example sand, are then filled in over the pipeline for covering the same and the actual concrete elements 1. So as to secure that for example this sand filling 7 is not carried away under the influence of waves and tide water, it is an advantage to add some cement to the sand.

After completed filling of loose mass or sand 7, and before curing of a possible cement addition, the supporting plates 4A, B are then pulled up from the elements 1. To this

end the supporting plates preferrably are provided with attatchment means 5A, 5B at their upper portions, for example in the form of suitable openings for a crane hook.

Fig. 3 shows a number of channel elements 21-27, for example of concrete, as described with reference to figs.1 and 2, in a finished installation with a pipeline 3 being extended inwards from the depth under the sea 20 to dry land. The sea bottom is indicated at 2', corresponding to the final level 2' in fig. 2.

Between the channel elements 21, 22, and 23 there is schematically indicated a connection means 31, 32 which can consist of cooperating and complementary parts at the respective ends of the channel elements. Advantageously these connection means can be adapted to make the interconnection somewhat flexible and shall serve to guide and align adjacent channel elements in relation to each other. In this connection it is of much significance that the channel elements be lying smoothly and well aligned in relation to each other so that the pipeline 3 to be arranged therein will not be subjected to great bending strain during any phase of the burying or installation.

Purely schematically in fig. 3 there is also shown a mobile equipment carriage 40 which can contain, inter alia, the above mentioned control unit for controlling the burying of the individual elements 21-27, whereby water supply conduits and suction tubes for the elements can be extended to the unit 40, as schematically indicated for the two elements 26 and 27. Unit 40 can also comprise the above mentioned water pump equipment 15. As in the case of a crane as mentioned above, the unit can be run on rails (not shown), mounted on the elements 21-27.

It is obvious that the design of the channel elements and the method of burying pipelines by means of such elements, can be modified in many ways in relation to what is described above with reference to the drawings. For example, the channel cross-section can be approximately U-shaped or possibly can be of a triangular shape, so that a more or less pointed bottom part projects downwards centrally in the space 16 between the skirts. In any case it is significant that

the mutual spacing between the two skirts substantially corresponds to the maximum width of the overlying channel.

Moreover, it is obvious that the actual channel element must not necessarily be made of reinforced concrete, but can for example in similarity to the skirts also be made as a steel structure.

C l a i m s

1. Channel element for burying pipelines for bringing ashore for example gas and/or oil in regions where the seabed (2) consists of loose masses such as sand, particularly in beaches and marshlands, said channel element (1) comprising an upwardly open cross-section having side walls (1A,B) and a bottom (13) which internally is adapted to support one or more pipelines (3),
c h a r a c t e r i z e d in the provision of a plate-shaped skirt (11A,B) along each side of the channel element (1) and projecting below the bottom (13) thereof, preferrably substantially aligned with each side wall (1A,B) respectively, that in a space (16) between the skirts (11A,B) underneath the bottom (13) there are provided nozzle devices (14,14A,B) for supplying water and fluidizing loose masses in the space (16), and that there is provided at least one suction tube (17) for connection to an external pump and with its mouth open into the space (16) for removing fluidized loose mass therefrom.

2. Channel element according to claim 1,
c h a r a c t e r i z e d in that the plate-shaped skirts (11A,B) have such a thickness and configuration, for example with a knife-like lower edge, that the skirts will penetrate a distance down into the loose masses concerned, under the influence of the weight of the channel element (1) alone.

3. Channel element according to claim 1 or 2,
c h a r a c t e r i z e d in that some of the nozzle devices (14) are located internally at the skirts (11A,B), and that preferrably a downwardly directed nozzle device (14A,B) is located adjacent to the lower edge of each of the skirts (11A,B).

4. Channel element according to claim 1, 2, or 3,
c h a r a c t e r i z e d in that at least one suction tube mouth (17C) is located at a corner portion between skirt (11B) and the bottom (13).

5. Channel element according to any one of claims 1-4, c h a r a c t e r i z e d in that at the upper part in extension of the side walls (1A,B) upwards there are provided supporting plates (4A,B) being detatchably mounted on the side walls (1A,B).

6. Channel element according to claim 5, c h a r a c t e r i z e d in that the supporting plates (4A,B) are received in slits (19A,B) formed in the upper portion of the side walls (1A,B) and are preferrably provided with attachment means (5A,B) for hoisting apparatus, for example a crane, adapted to remove the supporting plates from the slits (19A,B).

7. Channel element according to claim 5 or 6, c h a r a c t e r i z e d in that the height of the supporting plates (4A,B) above the side walls (1A,B) is somewhat greater than what corresponds to an intended maximum cover of the channel element (1) after having been buried.

8. Channel element according to any one of claims 1-7, c h a r a c t e r i z e d in that at the ends of the channel element (21,22,23) there are provided cooperating and preferrably flexibled connection means (31,32) for guiding and aligning adjacent channel elements (21,22,23) in relation to each other.

9. Channel element according to any one of claims 1-8, c h a r a c t e r i z e d by a control unit (40,15) for injecting water from the nozzle devices (14,14A,B) and/or the pumping effect through one or more suction tubes (17), for the controlled lowering of each channel element (21-27).

10. Channel element according to any one of claims 1-9, c h a r a c t e r i z e d in that sections of rails are mounted at an upper part of the element for supporting and moving equipment units such as a crane and the like.

11. Method of laying pipelines underground for bringing ashore for example gas and/or oil in regions where the seabed (2) consists of loose masses such as sand, in particular on beaches and marshlands, by employing channel elements according to any one of claims 1-10,
c h a r a c t e r i z e d in
- that a number of channel elements (1,21-27) are placed on the seabed (2) aligned in relation to each other and with their skirts (11A,B) projecting at least somewhat into the seabed (2),
- that water injecting through nozzle devices (14,14A,B) and pumping out through suction tubes (17) is carried out for a sufficient duration to have the channel elements (1,21-27) lowered to a desired level,
- that one or more pipelines (3) are laid or pulled onto the bottom (13) of the channel elements (1,21-27), and
- that loose masses (7) of a suitable character, for example sand, are filled in over the pipeline(s) (3) for covering the same and the channel elements (1,21-27) themselves.

12. Method of laying pipelines underground for bringing ashore for example gas and/or oil in regions where the seabed (2) consists of loose masses such as sand, in particular on beaches and marshlands by employing channel elements according to any one of claims 1-10,
c h a r a c t e r i z e d in
- that a number of channel elements (1,21-27) are placed on the seabed (2) aligned in relation to each other and with their skirts (11A,B) projecting at least somewhat into the seabed (2),
- that one or more pipelines (3) are laid or pulled onto the bottom (13) of the channel elements (1,21-27), and
- that water injecting through nozzle devices (14,14A,B) and pumping out through suction tubes (17) is carried out for a sufficient duration to have the channel elements (1,21-27) lowered to a desired level, and
- that loose masses (7) of a suitable character, for example sand, are filled in over the pipeline(s) (3) for

covering the same and the channel elements (1,21-27) themselves.

13. Method according to claim 11 or 12 employing channel elements as defined in claims 5, 6, or 7, c h a r a c t e r i z e d in that the supporting plates (4A,B) are removed after filling av said loose masses (7).

14. Method according to claim 11, 12, or 13, c h a r a c t e r i z e d in that said loose masses (7) comprising sand as a main constituent, are supplied with a proportion of cement or another binding/curing agent during the filling.

15. Method according to any one of claims 11-14 employing channel elements as defined in claim 10, c h a r a c t e r i z e d in that the channel elements (21-27) are successively deployed with a starting point on more or less dry land, by means of a crane adapted to be moved on rails formed by one or more channel elements being already deployed.

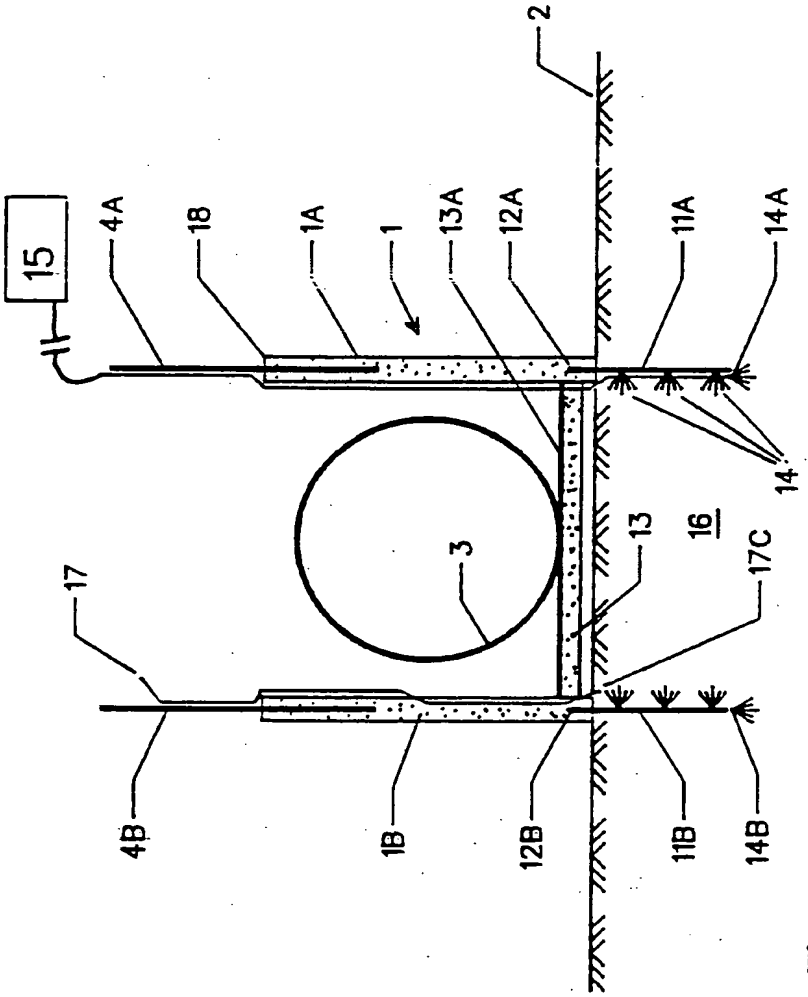

Fig. 1.

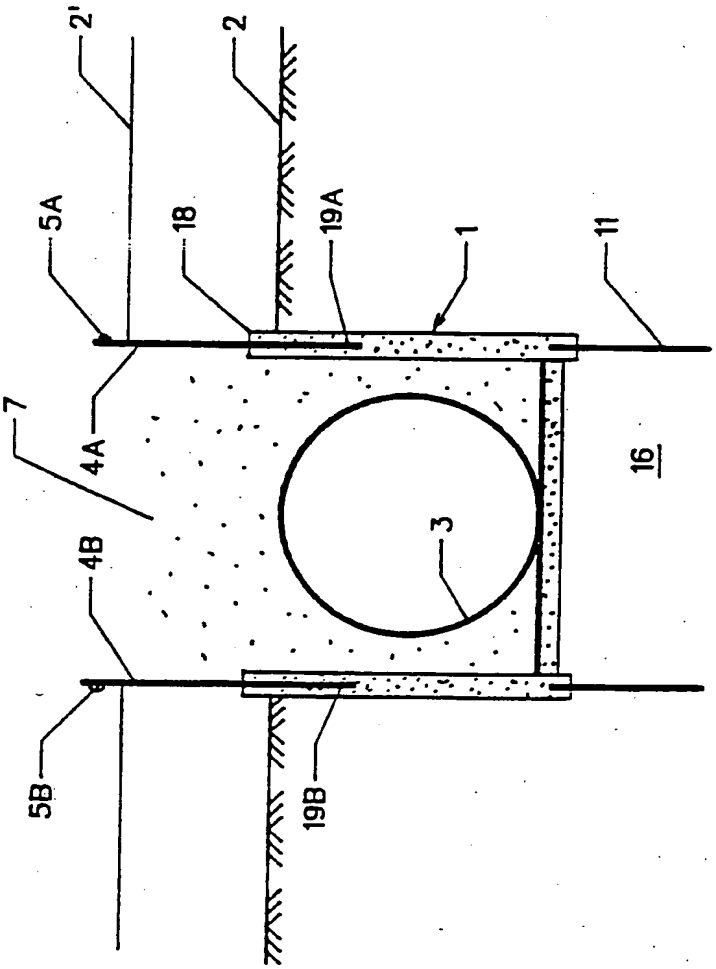

Fig. 2.

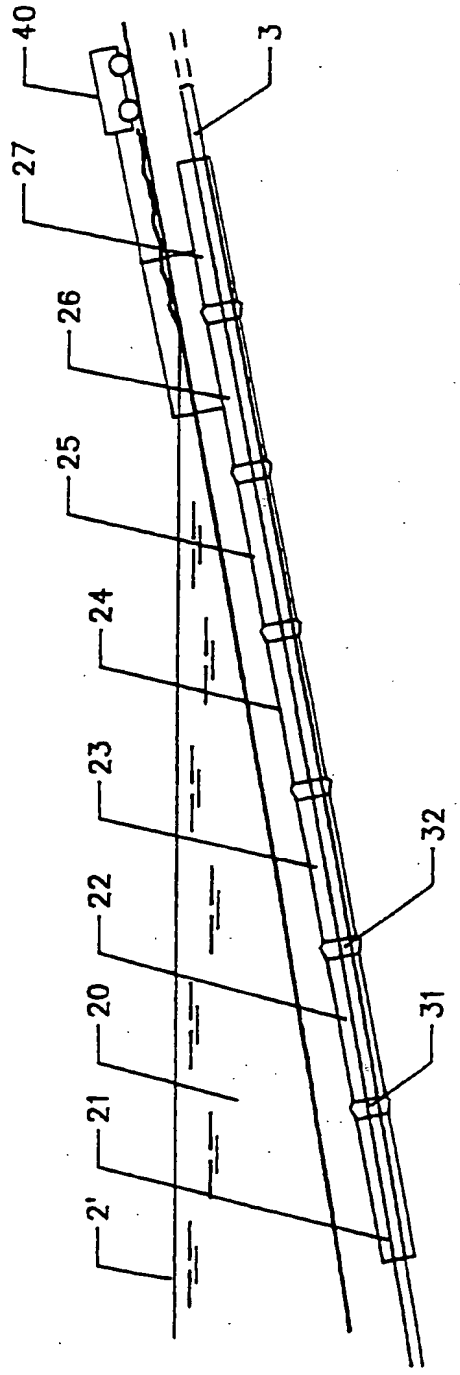

Fig. 3.

INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 92/00094

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: F 16 L 1/16

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	F 16 L

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	DE, B, 1801994 (BASER, HORST-D) 24 October 1974, see the whole document --	1-15
A	US, A, 4102145 (VAN STEVENINCK ET AL) 25 July 1978, see the whole document --	1-15

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* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25th August 1992	1992 -08- 27
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Axel Lindhult

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/NO 92/00094

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 31/07/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-B- 1801994	74-10-24	NONE		
US-A- 4102145	78-07-25	GB-A-	1547586	79-06-20
		NL-A-	7705989	77-12-06